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ORIGINAL COMMUNICATIONS.

ON THE INFLUENCE OF MICRO-ORGANISMS IN THE PRODUCTION OF CARIES.

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[Read before the Odontological Society of Great Britain, April 7, 1884.]

Mr. President and Gentlemen:

Mr. Milles and myself have so much to lay before you to-night in the form of evidence concerning the part played by micro-organisms in the production of caries, that we feel confident you will excuse us if we go straight to the matter in hand without an unnecessary waste of time in the form of preamble.

It is, however, necessary to state that we only propose to discuss the purely pathological side of the question to-night, and that only so far as the dentine alone is affected.

As we stated in 1881, we still consider that the initial stage, that is, the enamel destruction, is probably little more than a chemical

*By the courtesy of the author, and with the special permission of the Society, we are furnished with corrected proof-sheets of the *Transactions of the Odontological Society of Great Britain*, for April, containing the above paper. The discussion that followed the reading of this paper we hope to give in our next number.—ED.

solution of the tissue by an acid or acids; but we are inclined to believe that the greater part of such acids are the result of fermentation, a process which is entirely dependent upon micro-organic life, as has been amply proved by Pasteur, Lister, and others.

As the result of the decomposition of albumenoids, numerous substances are formed in the mouth—peptones and other similar bodies, fatty acids, acetic, formic, butyric, malic, lactic acid, &c., and in some cases sulphuretted hydrogen and ammonia are produced in large quantities. This decomposition is directly produced by the vegetation of micro-organisms.

A very simple illustration of this fact is obtained by filling two bottles with neutral saliva and bread, and rendering one aseptic, either by adding carbolic acid or boiling, or any other process of the kind. The micro-organic growth which will take place in the impure one will produce a large quantity of acid; the pure one will remain neutral. The most constant source of an acid reaction in the mouth is undoubtedly micro-organic fermentation.

This is not, however, the main subject of to-day's paper, and therefore we shall content ourselves with this passing allusion to it.

We cannot, however, refrain from expressing our gratification at the careful attention this subject has received from the profession, both here, in America, and on the Continent. Professor Mayr has worked out the chemical aspect of the question with great care and exactness; Mr. Tomes has done much in the direction of the effects of organisms in the soft tissues of the teeth; Mr. Spence Bate has given us many valuable suggestions in his able and exhaustive summary of dental science at Plymouth last year; Mr. Sewill has thrown out valuable conjectures upon the remote etiology of caries; and Dr. Miller, of Berlin, has done an immense amount of microscopical work, contributing a large array of evidence.

We have not been able until now to present our own views in full, because many of our experiments required a long time to verify and confirm; some afforded perplexing and almost contradictory results, requiring a long time to clear up and involving much repetition, and we may add, in explanation of the apparent delay, that what takes but little time to write or say often requires months and years of disappointment and patience to work out.

In the autumn of 1881 we were only justified in speaking with any amount of positiveness upon one point, namely, the actual presence of micro-organisms in carious dentine. This one fact, and the

evidence in support of it, formed the body of the paper we ventured to present to the International Congress. Micro-organisms were found in every fragment of carious dentine of which we cut sections, and we had cut immense numbers; the leptothrix of Leber and Rottenstein was, we found, a superficial growth.

Another fact of scarcely less importance, but one supported by far less evidence, was that the agencies to whose action caries had up till then been attributed by a large majority of scientific opinions, namely, certain acids, were unable to produce any such changes upon teeth exposed to their action alone, although the enamel protection was removed, and the acids employed were those present in the mouth. We had read many allusions to caries produced in teeth out of the mouth by artificial means; we employed the means indicated (whenever they were indicated, which was rarely), with the addition that we did so under absolutely aseptic conditions; we repeated the experiments, and the result of (in some cases) years of exposure was that no change that we could detect took place. Here was a second, but a negative fact.

The third fact obviously required was a positive one: it remained to inoculate dental micro-organisms into the flasks and observe the result. We did so, and the result was change in the exposed dentine, but so slight that we could not succeed in cutting a section; still, at the time of our paper of 1881, we firmly believed this change, when allowed to become more intense, would prove to be caries. Of the third fact we felt bound, however, to speak very cautiously, and for the last two and a half years we have employed every means in our power to clear it up—with what result we shall endeavor to make plain to you to-night.

We are anxious that you should keep clearly before you four main issues, upon which all the theory which we suggested to you in 1881 depends.

1. That certain forms of micro-organisms, namely, micrococci, rod-shaped oval bacteria, and short bacilli are invariably present in carious dentine.

2. That these micro-organisms extend into the tissue as far as does the caries.

3. That no agents can be made to produce a change resembling caries in the absence of such micro-organisms, i. e., under aseptic conditions.

4. That under septic conditions a change can be induced which,

although we are not prepared to call caries, does in some particulars resemble it; teeth in which this change has been produced we shall submit to you to-night, and also suggest to you why we hesitate to call it caries.

These four points once established upon reasonable evidence, we shall ask you to consider whether we are not justified in deducing from them the conclusion that micro-organisms play an important part in the production of the disease as we see it and are called upon to treat it, and that their active presence is an absolute essential to its production.

We may add, incidentally, that we never suggested that no other agency assisted in the process, although a recent writer attributes some such absurdity to the advocates of the germ theory. We do not consider ourselves justified in wasting your time over such a digression. The first point to discuss, then, is the constant presence of micro-organisms in carious dentine. Upon this point the evidence submitted to the profession by us in 1881 was very strong. We were then able to state that, since we had succeeded in properly cutting and staining sections, we had always discovered micro-organisms. The appearance was not caused by softening agents, because the teeth were cut fresh and immediately after extraction. The number of sections cut by us between 1879 and 1881 was so great that we were convinced that the phenomenon was constant.

Since then, Mr. Charles Tomes has, we believe, made some investigations which have led him to concur in this constant presence.

Dr. Miller, of Berlin, has cut a very large number of sections of carious dentine, with a result which is completely confirmatory of our assertion that micro-organisms are invariably present. In fact, this point has been confirmed by every careful observer, and may be considered to be completely established.

The second point is one very much more difficult to decide—the more so because statements have been made upon this point which tend very much to confuse the mind of the reader. It has been stated by Dr. Miller, who has written a very large number of papers upon this and kindred subjects during the last two years, that there is a zone of softened dentine of considerable width, not affected with micro-organisms, separating the normal dentine from that which is so infected; and further, that the outline of this area of softened dentine does not correspond with the outline of the area infected with organisms. We have attempted to verify this observation, but we

have arrived at the conclusion that if there be any such zone at all we cannot believe it to be of any considerable depth, as we have not succeeded in finding any softened tissue that did not contain micro-organisms. Having regard, however, to Dr. Miller's reputation as a careful and conscientious explorer, we do not desire to attach too much weight to negative evidence; later on we shall suggest some weighty positive evidence on this point. With regard to the outline, we have invariably found the outline of the changed tissue to correspond with that occupied by micro-organisms, and we feel less hesitation in doubting this latter statement of Dr. Miller because he claims to be able to compare these outlines with the naked eye, unaided by any instrument. We think that this is too rough a test for objects whose greatest measurement does not exceed the $\frac{1}{10000}$ of an inch.

There is no doubt that it is easy to establish a line of demarcation with the aid of a sharp instrument between tissue that you can easily prick and that which is quite hard; this line no doubt corresponds very nearly to the edge of the disease. We have also come to the conclusion that it corresponds very nearly to the edge of the micro-organic invasion; that is, we have cut sections as near as we could to the healthy tissue and found them infected. We do not, however, attach so much weight to this fact as to the following experiment, which we think must be allowed to be absolutely conclusive.

Before we can explain its full weight we must enter into a few details of the method we employ to grow and cultivate special germs. We used to make a meat infusion, boil it, introduce it with antiseptic precautions into aseptic test tubes, and seal the tube with wool. If the fluid remained clear we knew it was pure; if it became turbid within a day or two we knew our precautions had not been complete, and some germs had been introduced accidentally, and the tube was of course useless. If we wished to grow a special germ we rubbed a purified probe against the infected spot, and introduced it into the fluid, replaced the wool cap, and the ensuing turbidity denoted the growth of the germ. The objection to this plan was that the turbidity spread through the entire fluid, and if we had, despite our precautions, introduced any other organisms besides those we specially intended to introduce, they all became inextricably mixed in the ensuing putrefaction. To obviate this, we adopted Koch's plan of adding gelatine, and instead of a pure fluid, making a pure jelly; when this was inoculated in a particular spot the growth was confined to that spot, and if anything else dropped on the surface of the jelly

it grew there quite separate. Under these circumstances we noticed that different forms of germ grew in quite different ways—some, for instance, forming a white ball, others a mass of spiculæ, others wavy lines; these peculiarities of growth could be easily reproduced in other flasks by a second inoculation, until we found it quite easy to separate each variety and grow it by itself without any extraneous growth to confuse the result. We have brought down some flasks, with growth going on, to show you to-night. Well, we proceeded to inoculate flasks with those deepest portions of softened tissue which formed the most outlying layer of changed dentine, and we found that from these portions a growth of organisms proceeded, proving beyond doubt that organisms were contained in the pieces inoculated. This is not a doubtful experiment; it absolutely demonstrates that the deepest portions of the softened tissue contained organisms, and if there exist any zone of alteration beyond them it is so microscopically narrow that we have not been able to detach a fragment of it.

We do not, however, deny that there is a great probability that the advance guard of micro-organisms may be surrounded, and, *to a microscopical extent only*, preceded by a softening, the result of the action of those acids which they themselves produce. We shall be able to show that they do generate acids capable of softening dentine, and therefore we should expect to find this effect slightly in advance of their presence; but this is hypothesis merely. We would further add that the transition from very carious tissue to that which seems quite healthy to the eye and the touch is, in the greater number of cases, more sudden than is generally supposed, and allows but little space for this non-infected zone. To convince oneself of this, it is only necessary to split a number of carious teeth and prick the surfaces. One more fact should be borne in mind in this connection, namely, that healthy dentine softened by a weak acid does not look different under the microscope from healthy dentine cut fresh, and it is therefore impossible to detect the softening microscopically; the tubes are not larger, nor are they irregular, as is the case in carious dentine—in fact, the existence of such a softened and uninfected zone separating the infected from the non-infected dentine is a matter so difficult to demonstrate that we do not think much value is to be attached to it.

We now come to the third point, viz: that it is not possible to produce caries, or anything resembling it, by subjecting teeth to the action of acid fluids, in flasks out of the mouth, provided the flasks be kept in a strictly aseptic condition. We do not think this point

has ever been disputed, and we feel in position to state that the evidence upon which it rests is incontrovertible; but, before discussing it, and the point that follows it, we think it will not be a waste of time to explain what we mean by a change resembling caries. We mean a change by which the tissue affected is made distinguishable from that which is normal to the naked eye and touch or under the microscope. To the naked eye it must become discolored—we only mean changed in color, and not necessarily brown; the surface loses its polish, or, if moist, the affected part must be separable from the healthy with an instrument; to the touch it must become softer; under the microscope the channels must become dilated at the expense of the matrix. In 1881 we exhibited several flasks in which infusions of meat and saliva containing malic, butyric and other acids had been allowed to act upon exposed dentine for periods varying from one to three years; the teeth were liable to caries because they had suffered already from it; healthy portions were denuded of enamel and partially protected by wax, a certain part being left exposed with no perceptible result whatever. Of course a strong acid, or a large amount of acid, would decalcify the tooth, but this does not resemble carious change.

These experiments were sufficiently numerous and conclusive to warrant us in passing on to the fourth point of this investigation, and this will detain us longer than any of the others, as it is in this direction that we have experienced the greatest difficulty and the most perplexing results.

We were so fully alive to the overwhelming difficulties attending any attempt to reproduce out of the mouth the complicated conditions existing therein, that we should have felt anything but sanguine but for a curious accident that encouraged us to proceed in this direction. We will therefore commence by telling you the particulars of this accident.

At the Congress in August, 1881, we exhibited, among other flasks, a series intended to illustrate the fact that no change resembling caries could be induced upon the surfaces of teeth under aseptic conditions. These flasks all contained an infusion of meat and saliva with malic and butyric acid and teeth susceptible of caries, the surfaces ground down to expose the dentine, part of the exposed surface being protected with wax, so that any loss of substance could be at once detected in the exposed part. Now these flasks, which were labeled i, iii, iv, v, vi, had remained perfectly pure from the time they were

put up, June, 1880, till the Congress, August, 1881, that is, fourteen months, and no visible change had taken place in the exposed surfaces. In taking them home in a bag, flasks i, iv, and v fell down, allowing the fluid to come in contact with the cap covering the flasks; iii and vi remained upright.

In the course of a few days, flasks i, iv and v, which had tumbled down, became turbid; iii and vi remained, of course, pure. By the 5th of December, 1881, iii and vi were to all appearances, as before, unaltered; but the teeth in i, iv, and v were already discolored brown; moreover, the discolored parts were on the surfaces slightly softened, and although the change was so shallow that we could not obtain a good thin section of it, we could see that the tubes were enlarged and contained a material that stained readily, which, owing to the thickness of the section, we could not, unfortunately, identify. Now, whatever this change was, it was manifestly dependent upon the introduction of organisms; nothing else was introduced. Fourteen months' immersion in the fluid, when aseptic, failed to change the teeth at all; four months in the same fluid, plus germs, produced a change; the same additional four months, in the sister flasks, produced no change at all. This seemed an important addition to the facts in our possession at the Congress. The next stage was less satisfactory; the change did not seem to progress; do what we would, we could not produce a considerable change. We conceived that this might arise from the fact that several important conditions favorable to the activity of the germs in the mouth were absent in the flask. First, the temperature of the body; second, opportunities for lodgment; third, constant renewal; fourth, unlimited and varied pabulum; we therefore contrived a very elaborate experiment in which we proposed to assemble all these conditions, and as many more as we could think of. We erected a large incubator, which we kept continually at the temperature of the human mouth; it was divided into an upper and a lower story, which communicated by an aperture. In the upper story was a small bath with a tiny tap contrived to drip drop by drop through the aperture into a second bath in the chamber below; this again dripped into a receiver, the fluid being thus kept in constant circulation through the middle bath. In this middle bath were placed some teeth set side by side as in nature, the roots being implanted in a block of hippopotamus ivory, and weak points created in the interstitial parts with the burring engine, the size of the burr being kept to test any enlargement of the holes, and

some others implanted in wax. The upper bath was then filled with saliva, milk, bread, decaying teeth, meat, etc.; while some fragments of the latter were inserted about the teeth in the middle bath. The lowest receptacle was periodically emptied, while the top one was periodically fed. Without troubling you with more details, we thus contrived to assemble the proper temperature, the pabulum movement, and the normal disposition of the teeth. Now six months of this highly unsavory experiment produced scarcely any perceptible change, except that all the tissues became black, the holes drilled in the blocks and in the teeth were the same size, and their edges were not a bit softened. The putridity of the baths was, however, so offensive, that it was with some relief that we decided to abandon this particular experiment. We saw that some great essential condition was absent, and though a longer period might doubtless have produced slight changes, my health and appetite suffered from the constant exposure to all these putrid smells, and we agreed to stop the incubator; but this experiment, though apparently a failure, led us to what we conceive to be the true solution of the difficulty. So far we had decided only that some essential factor had been omitted.

The next experiment we shall describe is a repetition of one described by Dr. Miller, with this extension, that it has been carried out under septic and aseptic conditions. Two 8-oz. bottles were half filled with saliva; to this was added bread in both cases, and in one carbolic acid; into these were introduced fragments of healthy teeth extracted for regulation and split. The saliva was the same—i.e., from the same mouth—and taken at the same time, the bread from the same piece, the teeth were halves of the same tooth; both fluids were neutral. The bottle not containing carbolic speedily became the scene of an active growth of micro-organisms, for the greater part micrococci; a thick felt of this growth formed at the surface of the fluid. At the end of three months the surfaces of the teeth in the impure flask had become softened, but not discolored; the surface of those in the pure flask was unaltered, the fluid in the pure flask was neutral, that in the impure one strongly acid. Thus in the impure flask acids were generated as well as germs, or, as we think seems more rationally to express it, by the germs. The teeth from these fluids are here for your inspection. Lastly, a number of teeth are here for your inspection in which a change has certainly taken place after a long immersion in septic fluids.

It is plain, then, that whereas in the absence of germs no change

takes place that could be supposed to be caries, and that in the presence of germs a change does take place, which, although it would render our views more cut and dried to call caries, we are bound to confess is a very weak caries if it be caries at all; and further, remembering that unmistakable caries does affect natural teeth on artificial dentures which have no connection with the vascular system, we are led to inquire whether organisms, that are undoubtedly the prime factors in the production of other diseases, afford us any analogy of a loss of power when placed in strange conditions. The answer to this inquiry is very plain and direct, and completely in the affirmative.

Pasteur, Naegali, and other equally reliable authorities, have discovered that special organisms alter their character when grown under unusual conditions. Even though they continue to grow and reproduce their species, their special properties weaken and die out in the unnatural surroundings. Thus, to take a couple of typical instances, Pasteur, by growing bacillus anthracis at a peculiar temperature, "attenuated" the organism to such an extent that he was able to vaccinate animals with it—that is, he rendered this special bacillus, which, in its normal condition, would, if inoculated into an animal, produce anthrax, practically inocuous by changing its surrounding conditions. Again, Naegali has been able so to modify the properties of a lactic acid producing bacterium that it produced an ammoniacal fermentation. Lastly, certain pathogenic bacteria require a special soil in which to grow and a special temperature, otherwise the growth ceases altogether. Moreover, the presence of a number of extraneous organisms does in some cases hinder the active growth of others. A similar difficulty has attended the attempt to grow the organisms of gonorrheal ophthalmia, and such instances may be almost indefinitely multiplied; the conclusion is, however, pretty plain, namely, that special organisms require special surroundings to display their special activity, and we are inclined to think that in the case of the micro-organism of caries a living mucous membrane is one of those conditions.

In view of these facts, we feel ourselves justified in claiming to have established as a permanent addition to dental pathology the fact that micro-organisms of a special form do play an important part—nay, more, that they are an essential factor in the production of caries. We think many of these experiments show that these organisms do much of the work—at any rate, as far as the removal of the lime-salts goes—by the aid of an acid which they produce. We feel con-

vinced that the process, to be effective, must be carried on in a living mouth, probably because that is the only situation in which the special germs are really active. Analogy seems to warrant this deduction; but, before concluding, we wish to impress upon the meeting, and through the meeting upon all who take an interest in the matter, that all we claim for the germs is, that without them and their products the process could not go on at all. The essential element that was not present in our artificial experiments is present in the mouth; it is possible, and we consider from the analogies quoted above, *probable*, that this important element is the living buccal mucous membrane as a scene of operations, and the constant succession of the proper germs. Enough has, however, been laid before you to induce us to hope that this Society will indorse the statement made by us in the August of 1881, and repeated more fully now, that micro-organisms play an important part in the production of caries, and that the dental pathology of the future must include them among the most powerful factors in the production of this disease.

We have only, in conclusion, to thank you, gentlemen, for your kind attention, and to leave the question in your hands for discussion.

A HISTORY OF DENTISTRY.

BY GEORGE H. PERINE, D. D. S., NEW YORK.

[Continued from page 274.]

The Professional Advancement in this Country.

The wonderful advancement made in this country in every art and science within that brief space occupying the interval between the opening of the nineteenth century and the present time, has caused the eyes of the old world to turn toward us in astonishment, and the history of this age generations hence will appear to the reader more like an Arabian Nights' tale than a statement of sober truth. Dentistry has more than kept pace with the other arts and sciences in their advancement toward perfection. The first step in her upward journey at the opening of this century was, we consider, the publication in Baltimore, in 1801, of a treatise on the teeth, by Dr. R. Renner, a practitioner in that city, which is generally believed to have been the first upon the subject published in this country. Following closely upon Renner's little work, came one from the pen of Dr. B. T. Longbotham, also a Baltimore dentist. The object of this work

was to enlighten the public regarding the importance of dental treatment, and in it the writer advanced new theories as to the cause of diseases of the teeth and gums. To the life and labors of the distinguished men of which we will speak, the history of our profession in this country is largely indebted. Bringing to its aid minds of extraordinary culture and capability for skill, their influence was deeply felt and gave importance and respect which was widely extended to our then neglected science.

JOHN RANDALL was born in Massachusetts in 1773. He graduated from Harvard University and commenced practice in Boston about 1805; he was induced to undertake the study of dental surgery during his college career, through the ignorance displayed regarding that important branch of medical science, by a prominent medical man. When Randall began practicing, dental operations consisted almost entirely in the extraction of teeth, and the introduction of artificial dentures, little or no attention being paid to the treatment of diseases of the mouth. The number of practitioners who deemed the preservation of the teeth a subject worthy of their consideration was exceedingly limited. Randall, adopting the theory that there is no disease without a remedy, applied himself to the task of discovering a proper mode of treatment for diseases of the gums and carious teeth. By perseverance and study, he became proficient in the dental art, which he practiced in connection with the science of medicine. He was particularly successful, and his active professional labors covered a period of over forty years. He died in 1843.

To give the reader an idea of the crude state of the profession, or at least the limited knowledge possessed by some of those who undertook its practice, we may call attention to

LEONARD KOECKER, a German, who began practice in Baltimore in 1807. With a few instruments and an abundance of assurance, he made known his intentions. His first operation was the extraction of a tooth which he performed with closed eyes and palpitating heart, very much after the manner of a boy making his first shot with a gun. It is recorded that the patient survived. Koecker, after something of a struggle, met with success, and gained a high reputation as an able and skillful dentist. From necessity, he made many of his instruments and annealed his own gold foil. Leonard Koecker was born at Bremen, in 1785, and while still young he came to this country. In 1822 he returned to Europe and settled in London. Between 1826 and 1835 he published works on Dental Surgery, Artificial Dentures, etc. His death occurred in London, August 8, 1851.

BENJAMIN JAMES was in successful practice in Boston about this time. He was a man of somewhat exclusive habits. In 1814 he published "A Treatise on the Management of the Teeth."

It was in the year 1816 that John A. Szymanski came to the United States, and located in Philadelphia. He afterwards traveled over the States, and practiced in many places with success, and did much to advance the specialty in this country. He was born at Warsaw, Poland, in 1793; graduated in medicine at Dantzic, and in 1814 commenced practice. He went to Sweden, and entered the hospital at Gottenburg, where he remained for a time; thence to England, and devoted his attention exclusively to dentistry. Dr. Szymanski possessed a thorough scientific knowledge of his profession, and was a gentleman of fine education, courtesy and polished bearing. His death occurred in January, 1829.

A. A. PLANTAN came to this country from France, about 1817, and settled in Philadelphia, where he began practice. He was a man of fine education and brilliant attainments. His interest in the advancement of the specialty was marked, and his improvements many. He was the first to introduce and manufacture porcelain teeth in this country. He was born in 1774, and died in the sixty-fifth year of his age.

About this period, Levi S. Parmly, the oldest of the five brothers, four of whom became dentists, had gained considerable prominence in Boston as a dental practitioner. He was a student under Dr. Petrie, an English dentist, in 1812, and, being a man of superior talents, gained for himself a high professional reputation. In 1815 he went to Montreal, and thence to Quebec, where he practiced for some time; from Canada he returned to the United States, and tarried for a period in the West and South. Later, he made his way to London, where he practiced for a few years. In 1819 he published a work entitled "A Practical Guide to the Management of the Teeth." In 1821 Dr. Parmly delivered lectures in this country on "The Natural History and Management of the Teeth," the causes of their decay, etc., and was also the preceptor of several, who afterwards became quite eminent as practitioners, among whom was a younger brother, Dr. Eleazar Parmly. In 1845 Dr. Parmly presented to the profession a valuable paper on Dental Hygiene, which attracted considerable attention. Dr. Parmly returned to Europe, settled in France, and died in Versailles, July 8, 1859. His remains were brought to this country, and interred at Perry, Ohio, August 29, of the same year, that being the seventieth anniversary of his birthday.

The effort made by active members of the profession to induce the public to realize the importance of dental treatment began at length to produce in a measure the desired effect, and practitioners who had hitherto remained inactive awoke to a sense of duty, and soon began to assist in every way in their power toward the advancement of professional interests, and "Observations on the Teeth," a small work was published in 1820, by Dr. Essevein of Charleston, S. C., and a second edition of the same work somewhat enlarged appeared a few years later.

In 1824 Dr. Elazar Gedney, who had acquired a high reputation for skillful practice, both in this country and in England, published in Utica, N. Y., where he was then located, a small book bearing the title, "The Human Teeth." Gedney's successor in Utica was Dr. A. Blakesley, a skillful dentist, who for years retained the confidence of the community in which he resided.

About this time the number of dental practitioners in the United States did not exceed one hundred, and this number included Dr. John Trenor, of New York (who in 1823 contributed to professional literature a paper on the Teething of Infants, and in 1828 presented his "Physiological Inquiry into the Structure, Organization and Nourishment of the Human Teeth," and a year later his "Observations on Neuralgia" appeared, also "Remarks on Dental Education"); and Dr. Samuel S. Fitch, of New York (author of "A System of Dental Surgery," a valuable work of reference, published in New York, 1829, the second edition of which was published in Philadelphia, in 1835, whither the writer had removed).

With each succeeding year the number of the specialty rapidly increased, and with this augmentation naturally came increased knowledge and enlightenment, and a desire on the part of the people for proper dental care so greatly increased the demand for the services of skillful practitioners that many were accustomed to migrate into the rural districts, or make periodical visits to neighboring, and in some instances distant cities.

Among these itinerants of worthy professional reputation were Drs. Brewster and Cleveland, Ambler of South Carolina, Hayden and Harris of Maryland, Brown and Hale of Missouri, McReynolds of Georgia, Badger of Tennessee, Hullihen of Virginia, Flagg and Townsend of Pennsylvania, Keep and Miller of Massachusetts, Taylor of Kentucky, Baker and Parmly and Solyman Brown of New York. The latter, who contributed somewhat liberally to dental literature,

will doubtless be remembered by many of the old residents of Long Island, from the fact of his traveling from place to place in considerable state with his chariot and pair, and there is no reason to doubt that a few traces of his skill still remain, reminders of the days when dentistry was little thought of in the rural districts until its missionaries, so to speak, brought it to the very doors of the people, and thus gave them an insight into the benefits it was destined to bestow upon mankind. Not all, however, of those who made professional pastoral pilgrimages left behind them enduring traces of their skill; but often, quite to the contrary, fractured jaws and partly extracted teeth impressed upon the mind of the unfortunate patient a recollection which years could not remove, and ever after caused the sight of a dentist's *modest sign, in the shape of a somewhat exaggerated gilded tooth*, to produce convulsions of an alarming character. Perhaps the following anecdote, which may be somewhat embellished, but which will give the reader a fair idea of the character and skill of some of the itinerant so-called dentists of the early days of the profession, may prove interesting:

To a certain small hamlet, in the days before railway tracks intersected each other in all parts of the country, like the network of telegraph wires hung in the air like spiders' webs on a summer morning, there came with staff in hand and kit on back a youth who, through the medium of a circular couched in questionable English, announced his willingness to perform for a moderate fee all manner of dental operations, from the extraction of a deciduous incisor to the insertion of artificial dentures likely to cause Dame Nature to blush at her inefficiency in her dental efforts. Several simple operations performed with comparative success were instrumental in procuring for our disciple of Wooffendale a desirable patient in the form of a well-to-do but rather intemperate farmer, whose upper teeth were entirely gone, and who gave our knight of the forceps an order to supply their place with an artificial set, which were accordingly constructed and inserted, and the practitioner, having received his fee, buckled on his kit and set out for the next town. The distance being something like thirty miles, he was obliged to pass a night at a wayside tavern where, the next morning, he was at an early hour called upon by his late patron. "Look a here," shouted the irate tiller of the soil, confronting the astonished tooth manipulator, "what do yer take me fer, anyhow—a huskin' machine? Look at this 'ere corncob what you put inter my mouth yesterday; there ain't a kernel left

on the infernal thing," and the indignant rustic produced the bone base from which every tooth had disappeared. "Good heavens!" exclaimed the professional gentleman, in apparent astonishment, and then, as if seized with a sudden thought, he inquired, "what did you eat after those teeth were put into your mouth?"

"Mush and milk," replied the farmer.

"And what did you drink?"

"Apple brandy," was the reply.

"That accounts for it," exclaimed the practitioner, impressively. "You see, sir, the teeth I made you were attached to a base composed of hippopotamus ivory. Now, sir, you must understand that the hippopotamus is an animal which lives a greater part of the time in the water. In the temperance sense it is totally an abstemious animal, and when the fiery beverage you are accustomed to came in contact with the fragment of the animal's anatomy, to which your artificial teeth were attached, the shock was great, and actually produced so decided a shock among the nerves contained in the bone that the teeth were dislodged from their setting."

If not satisfied with our friend's explanation, it is safe to conjecture that the farmer withdrew from the presence of his dentist somewhat mystified.

[To be continued.]

GRANULATED BONE AS AN ARTICLE OF DENTAL HYGIENE.

BY H. E. DENNETT, D. D. S., BOSTON, MASS.

In the discharge of their duties, the physician and dentist are daily asked by their patients, "What shall I do to prevent my teeth from decaying?" The answer must be, "Correct your diet." That is, eat such food and only such as contains all its natural elements. If we eat the products of grain, we should eat it with all its elements as furnished by nature. If we eat meat, we must eat bones, or our systems will suffer from this violation of one of nature's unerring laws. Dental development in man is discernible as early as the seventh week of intra-uterine life; hence, the importance of a strictly correct diet from the start, if mothers desire to give birth to children who may have perfectly formed teeth. The same dietetic rule will secure the foundation for a good bony framework. A mother who passes through the periods of gestation and lactation without a sufficient amount of bone and tooth element in her food will suffer from decay of the

teeth, accompanied with the usual pain and suffering in proportion to the extent of the deficiency. The lime will be dissolved from her teeth, taken into the circulation and appropriated by the offspring. Excepting civilized man, all flesh-eating animals eat as much of the bone of the animal they devour as they can break with their teeth sufficiently fine to swallow, and all have good dental organs. Place before a tribe of Indians everything the earth produces in the shape of food and they will eat only animal food as long as that lasts; but place them upon a reservation, and feed them as civilized people feed themselves, and they too soon suffer from decay of the teeth. Take from either of the above classes their supply of bone which they can get with their animal food and decay of the teeth is sure to follow. Even our domestic herbivorous animals thrive better by having bone added to their bill of fare.

The cow which every year gives birth to young has an excessive drain upon her for bone material, and craves bone to such an extent that she will even try to masticate large ones, as every farmer's boy can testify.

Veterinary surgeons have long known that certain diseases of their dumb patients can only be successfully treated by giving them bone meal.

Persons engaged in raising poultry know that their birds must have lime supplied to them or they will furnish only soft-shelled eggs. Bone is now acknowledged to be the best fertilizer for New England farms. Visit one of these farms in the month of June, and you can count the hills half a mile away where the corn grew three years before by the spots of grass which stud the earth at regular intervals. The farmer will tell you that "bone did it." The evident deficiency in the soil explains the too apparent lack in the products of the soil.

Arguments in favor of eating bone to prevent decay of the teeth, as well as to cure a long catalogue of bone and kindred diseases, might be continued indefinitely; but, as "A word to the wise is sufficient," it seems only necessary to add that the results obtained from an experiment, long continued, upon an entire family, were such as fully to establish its beneficial effect.

The bones used were selected from perfectly healthy animals, none being accepted that bore the slightest blemish, carefully cured, without being allowed to pass through any perceptible chemical changes, finely granulated and incorporated into soups, gravies, bread, etc., in the proportion of from one to three spoonfuls with each pint of gravy, soup or flour.

The relative proportion of nutritive elements in one hundred parts of different kinds of animal food have been found as follows: Beef, 26; mutton, 29; pork, 24; chicken, 27; codfish, 21; blood, 21; brain, 20; white of egg, 14; milk, 7; bone, 51.

EDITORIAL.

NITROUS OXIDE.

Speaking of this agent, the *London Morning Post* fears that the growing practice, especially among dentists, of administering it single handed, will be productive of mischief, and will tend to discredit its employment, even in a proper fashion, and it doubts "whether the theory and practice of this and other anæsthetics is sufficiently taught in our medical schools. A special certificate from an expert is required to qualify a medical practitioner for performing the very simple operation of vaccination; and it might be well to apply at least an equal test to the student's knowledge of the art of sending his patient to the realms of happy unconsciousness, and, what is more, of bringing him back again."

A SIMPLE OPERATION IN FACIAL NEURALGIA.

Under this designation, Dr. Heustis, Professor of Surgery in the Alabama Medical College, describes an operation which he performed on a gentlemen above seventy, who was in good health in all other respects, except that he suffered from severe facial neuralgia, affecting both the infra and supra-orbital nerves. As the patient had become much weakened by the severity of the pain and his inability to eat his food, it was deemed desirable to render an operation performed upon the infra-orbital as simple as possible, consistently with its efficiency. "Therefore, discarding Carnochan's operation of trephining the antrum, and following up the nerve beneath the orbit and removing it, and Langeubeck's slighter one of dividing the nerve with a tenotome, and drawing it out through the infra-orbital foramen, I merely cut down upon the foramen, and with a fine steel drill, such as dentists use, improvised of piano wire, drilled out the nerve in its entire length, as far back as the sphero-maxillary fissure." The relief obtained was immediate and complete, and had so continued two months after the operation.—*Philadelphia Medical News.*

We are pleased to learn that Dr. W. D. Miller, of Berlin, may be expected in this country before many weeks. His native land will extend to him a warm welcome, surely.

MEETING OF THE NEW YORK DENTAL SOCIETY.

It was a very pleasant privilege of ours to attend the annual meeting of the New York Dental Society, which was held at Albany, May 14 and 15, and we regret that our space will only allow a brief notice thereof. For very many courtesies shown us we are profoundly grateful. Judging by the character of the two sessions we attended, the meeting must have been one of much importance and interest. Many of the papers were of high character and will make an impression upon the dental world far beyond the limits of the New York Society: Notably those by Drs. Miller and Abbott, the latter being the "prize essay" of this year.

Dr. Miller's paper was a culmination of his long series of papers, and is a scientific thesis on the most prominent question that at present occupies the minds of the dental profession, namely, Antiseptics. We shall take great pleasure in giving our readers this paper in our next number.

The report of the entire proceedings of this meeting may be looked for with interest, and we trust that the Society will delay the issuing of this report for as little time as possible.

Among the several matters of Society legislation that came up was one that is of national importance. It appears that the dental law of the State of New York gives this Society the power to designate the colleges whose diplomas shall entitle the possessor thereof to practice dentistry in the State. In accordance with this law the Society, at this meeting, adopted a list of medical and dental colleges whose diplomas will "pass muster," and which are to be placed in the hands of each county clerk for their government. Consequently, hereafter, any one who does not possess a diploma issued by one of the colleges named on this list will be debarred the right of registration and practice in the State, unless, perchance, he passes the regularly constituted Board of Censors, who are also appointed by the Society. It thus appears that this Society possesses a pretty strong "twist" upon the colleges, and that they propose to use it hereafter. There were some significant *omissions* on this list as adopted, a fact which those interested will probably take early notice of. Nor is this all. By practically a unanimous vote, a resolution was adopted, "requesting" the faculty of one of the oldest dental colleges in the country to appear before the Society at its next meeting "to show cause why the name of said college should not be stricken from the list," and that parties holding diplomas from said college be debarred

from "registering" until such time as the faculty shall thus appear and satisfactorily explain, or meet, the charges made. The charges, we understand, are irregularity in issuing diplomas. We do not understand that the Society wish to cast any dishonor upon any college whose name does not appear on this list as adopted but, rather, that they are not at present sufficiently informed as to the standing of colleges so omitted. It would seem, however, that this Society possesses the power, conferred by the law of the State, to brand any college with the stamp of dishonor and publish the fact to the world.

It is of no little significance to the dental profession that there is a power already in existence that is thus enabled to "go behind the returns" of our colleges. If more of our State Societies possessed the same power it might prove advantageous to the future of dentistry in this country.

The following gentlemen were made the recipients of the degree of M. D. S.: J. J. Mills, Poughkeepsie; Lonado Frazee, Brooklyn; A. M. Wright, Troy; H. Allen, Gloversville; DeWitt Barker, Brooklyn, and L. M. Hall, of Rome.

The report of the Committee on Dental Law recommending that steps be taken to erase from the dental register in each county names of persons who have registered illegally, and on diplomas obtained from the "diploma mill" at Delavan, Wisconsin, was adopted.

President Straw, in his annual address, referred to the cause and prevention of the wide-spread decay of teeth, and felt impressed with the idea that the profession could not better fulfill its destiny than by devoting itself, heart and soul, to the great educational work of how best to fight the fell destroyer.

The physician and dentist should make themselves felt to be the dispensers of that knowledge which will guide the erring into paths of rectitude and happiness—should inaugurate a day of scientific investigation which would create a stampede toward the goal, where prevention more than remedy holds sway. The rising generations should be educated in the theology of all that concerns brain, muscle and nerve, and rampant luxury and debasing habits of all kinds would give place to high-toned morals, and smooth, physical running gear would be the sure result.

Dr. W. D. Miller, of Berlin, was unanimously elected an honorary member of the Society.

MICRO-ORGANISMS.

At a recent meeting of the Royal Medical and Chirurgical Society of London, Dr. Henneage Gibbes exhibited a number of the different forms of putrefactive bacteria: A section of diphtheritic membrane, showing two forms of micrococci, one large in groups, the other much smaller in masses. A section of human spleen from a case of tuberculosis, showing large micrococci in groups; similar organisms were found in the liver and lungs of this case. Sections from the livers of two pigs, which had died of the purples or "red soldier." These were sent to Dr. Gibbes by Mr. Crooke, of the Leeds Fever Hospital. Sections of these livers were full of bacteria, but the forms were quite different in each. In one liver the bacteria consisted of short rods not joined together, in the other they were very long and slender. Sections of kidney from one of these cases showed the vessels full of a form quite different to those in the liver. Stool from a case of infantile diarrhœa, showing organisms very similar to those in the specimens of rice-water stools sent by Prof. Strauss. Very large organisms from the stomach in a case of carcinoma of pylorus spirilla vibriones, various forms of bacteria in chains, micrococci from putrefying animal matter in water. Section of mesenteric gland, showing the so-called typhoid bacillus. Human sputum from cases of tuberculosis; one specimen showed different forms of bacteria in the field of the microscope, and this with an oil immersion lens magnifying 600 diameters. These specimens were shown with Messrs. R. & J. Beck's new pathological microscope, which they have made from Dr. Gibbe's designs.

TIME OF MEETING CHANGED.

The semi-annual meeting of the Connecticut Valley Dental Society will be held at Savin Rock, New Haven, June 19 and 20, instead of on the 18th and 19th, as at first announced—the change being made on account of the ceremonies connected with the unveiling of the Buckingham monument, at Hartford, June 18. A large attendance and a good meeting are assured.

THE INTERNATIONAL MEDICAL CONGRESS

Will meet at Copenhagen this year, during the month of September. It will not have a section devoted especially to Dentistry, but in a letter from the Secretary we learn that measures will be taken to provide for this specialty in the section for Surgery, provided the number of dentists present should prove sufficient to warrant it.

ROBINSON'S FIBROUS AND TEXTILE METALLIC FILLING.

We have before spoken in commendation of this material, but after a personal experience of more than a year we wish to further emphasize our appreciation of it, as a filling material especially. That it is a good thing when used as a lining for vulcanite work we have no doubt, but cannot speak from a personal experience. As a filling material we are using it with great satisfaction and to a much larger extent than formerly. We have yet to see a single case where we have had the slightest reason for regretting its use; on the contrary, results have invariably shown the wisdom of using it. We, however, have only used it as a base upon which to build gold. We have never had a case where gold has failed to adhere to it, or cleaved from it afterwards. It is used rapidly and easily, and is a great help in starting a filling of gold at difficult points of access. At the cervical margins we believe it to be much safer than gold, and where cavities are deep we almost invariably use it as a means of preventing thermal influences. It is a great saving of time and labor to the operator, and we fully believe that, in very many cases at least, its use adds very materially to the lasting qualities of the operation, to say nothing of the future comfort of the patient. We would almost as soon think, to-day, of abandoning gold itself as to try to get along in our practice without this material. If any dentist does not use it, it must be that he does not understand its excellent qualities.

We say this because of our interest in the good of the profession. We have not the least interest in its sale or manufacture, and have not even been *asked* to say anything of the kind by those who are so interested.

A NEW CHEMICAL PRODUCT.

Mr. Kordig presented lately to the Society of Encouragement an inflammable liquid, producing a white flame, which does not burn the body, not even heating the point from which it burns.

A finger dipped in this liquid and lighted would serve to light a candle near by, without feeling the heat; spread upon the floor, the handkerchief, hay or straw, the liquid alone burns without setting fire to the objects which it touches. This liquid boils at 31° C., and it is thought to be very carbonaceous and volatile. Its evaporation lowers the temperature of the parts it touches and protects them against the changes which the combustion would otherwise produce.

Whatever may be the interpretation, it is a liquid endowed with

very valuable qualities. We know that gun-cotton burns upon the hand without the heat becoming unbearable, and that it can be burnt upon a heap of powder without the latter taking fire, but this new product far surpasses the gun-cotton.—*Moniteur Scientifique.*

Dr. J. E. Garretson wrote to us one of his pleasant letters about our criticism of the term "vice of syphilis," which he used in his book. We agree with him perfectly in what he says, that he used the term in the sense of a defect, only the term "vice" has at present assumed overwhelmingly such a peculiar church meaning that, whatever may be the meaning put by the old Latins to the word "vitium," or by some classic writer to its English derivative, "vice," the term will be and has to be understood by its more common meaning. The use of such a term which has assumed a very different meaning in a sense which, while correct, is not at all the common one, was exactly what prompted us to the criticism; it is not that we do not acknowledge that this use may be justified, but we like the extermination of all vague, obsolete and otherwise objectionable meanings of words for which we have more exact and unmistakable scientific terms. The terms "syphilitic ailment," "syphilitic cachexia," "syphilitic derangement," "syphilitic diseases," are all more precise than the term "vice of syphilis," which smells moldy, and parson-like. It may be an almost worthless splitting of hairs, but these little hairs constitute the language, and our ideas are apt to become muddled if famous teachers use words in an ambiguous sense.

Rich people and rich bequests are not restricted to America. The Countess of Bose has bequeathed $200,000 to a scientific society at Frankfort, $180,000 to the University of Jena, $180,000 to the University of Bonn, while a banker of Cologne has built a foundlings' asylum in that city costing $280,000; this in one week. It may be seen that while the Americans mostly give money for missionary and priesthood purposes, the German gives his for scientific purposes.

Every tissue, by the inflammatory process, is reduced to the condition in which it existed in the first stage of its development—that is to say, to a condition corresponding to its embryonal state.—HEITZMANN.

UNDERWOOD'S PAPER.

We are pleased to place before our readers Underwood's paper "*On the Influences of Micro-Organisms in the Production of Caries*," which may be found in this number of the JOURNAL. To Underwood and Milles belong the credit of first calling the attention of the dental world to the fact of the actual presence of micro-organisms *in* carious dentine; their paper of August, 1881, read before the International Congress clearly demonstrated this fact. Since that time many others have verified their observations, and have assisted in bringing the matter before the profession in such a way as to command universal attention, and to excite the inquiry as to the details of their action. As a result, the conclusion is forced home upon every mind, who has kept abreast with the investigations, that micro-organisms of the various classes are the essential factor in dental caries; that without them caries is impossible. If, heretofore, any one has doubted that the evidence was sufficient to warrant such a conclusion he will only need to carefully and understandingly read this last paper in connection with the series published by Dr. Miller, in order to arrive at the conclusion that there is no escaping such a claim. It being thus clearly proven that the production of destructive acids is *dependent* on the action of micro-organisms; that the "inflammatory action," if any, is the *result* of their action, there can therefore be no longer any question as to the propriety of placing these organisms at the "head of the procession." It will be remembered that Mr. Underwood asserted, during the discussion that followed the reading of his paper before the International Congress of 1881, that "Germs are never secondary, but always primary" causes of caries. A further investigation, not only by himself but by others, shows that this assertion is based upon indisputable facts, and needs no modification. The "head devils" in the warfare against the teeth are unquestionably micro-organisms. It is the inward persuasion of this fact, even if not openly admitted, that gives a semblance of pertinence to the question of antiseptics, which so largely engrosses the attention of the profession at the present time. A careful reading of the paper is suggested.

TRANSLATIONS.

SUBSTITUTES FOR LOST JAWS.

BY DR. W. KAY, OF BERLIN.

[Translated from the Zahntechinsche Reform, February, 1884.]

Continued from page 158 of the Journal for April, 1884.

The next step is the modelling of the piece. The substitute we now make is often but a trial piece, as we have in many respects to work a great deal according to our judgment; there is no certainty that the finished piece, as modelled, will harmonize with the proportions of the face; whether the size of the mass which is to obviate the defect is suitable. As the substitute for the case now under consideration is to be held by two teeth, it is evident that with the considerable strain to be put upon them, the substitute must be made as light as possible, in order not to loosen the supporting teeth by too great pressure. We cannot, therefore, fill the defect with a massive substance, neither can we form the plate according to the shape of the defect, as then the arch of the mouth necessary for a correct speech could not be obtained. The substitute must therefore consist of a hollow mass which gives on the lingual side the regular shape of the roof of the mouth. We now, for this purpose, after removing the articulating plate, apply again a strong gutta-percha plate to the upper model and press it tightly everywhere, especially in the cavity of the defect. Then we take the clasps out of the articulating plate and press them into their place in the gutta-percha. Then we take loose cotton-wool or prepared wadding about the size and form of the cavity, put it into it, and cover it with a wax plate so that the shape of the roof of the mouth is obtained. Now the teeth are fitted according to the articulation, and the substitute is tried in the mouth. If everything fits and the articulation is satisfactory, we next make the mass according to judgment, higher and thinner toward the outside. This has the purpose of evening the impression, which has, in consequence of the contracted buccal muscles on these places, proved too small, as may with certainty be expected. The substitute is coated with oil and carmine, put upon the model, and the plaster is removed at the marked places, till the plate fits accurately on the model. A buccal protector is now formed on the side of the substitute, a little above the teeth, which, starting from the incisors, is increased in breadth as it goes farther back, but hollowed out on the side facing the teeth.

This is done in order to aid the expansion of the buccal muscles and to make the cheeks fuller, and to prevent the mucous membrane from being caught between the teeth in mastication. This addition should reach to the pharynx on the defective side and be made sufficiently long to close the aperture leading to the nose, if desired. Having gone thus far the model is secured, with the plate on it, in the lower part of the flask. After the plaster is well hardened, everything is well oiled except the teeth; then the upper part of the flask is placed in position and filled. After the plaster is hardened the flask is well warmed, so that the gutta-percha may become soft, and the teeth, when opening the flask, easily come out and remain in the plaster of the upper part of the flask. Now the wax is scalded out and the gutta-percha and wadding are removed. The surface is now everywhere covered with talc, and a plate of common red rubber placed upon the model and also very carefully pressed into the cavity of the defect; then the cotton-wool, covered with rubber, is also placed in the cavity, and more rubber added, as it may be required. The canal leading to the nose is then filled with palate rubber. Then the clasps of the teeth in the upper part of the flask are covered with small pieces of rubber and the cavity of the buccal protector also filled. After this, the two parts of the flask are carefully put together, heated and pressed to each other, small drainage canals having of course been previously made all around the flask. When opening the flask the rubber adheres to the upper part in consequence of the model having been covered with talc. and we can thus ascertain whether sufficient rubber has been used. As the plate and its additions do not have anywhere excessive thickness, it is not necessary to vulcanize at a very low temperature. After vulcanizing, finish up and prepare for the mouth. As I have already mentioned, this substitute serves very often only as a trial plate, in order to expand the muscles and ascertain whether it can be worn with ease. Should there be too much pressure in some places, then filing is necessary until it disappears. If but little filing is needed, we can polish these places, and the substitute can then be worn. But if much has to be removed, so as to make an aperture in the substitute, it must not be patched, but a duplicate should be made. For this purpose a fine layer of wax is melted on the defective places, so that the case shows everywhere a smooth surface. Then plaster is poured on the palate side, about the height of a model, and plaster allowed to fill in the space surrounded by the clasps, but elsewhere to go only as far as the edge of the case, so that it may be easily

taken off. The model so obtained is trimmed, and one channel lengthwise, and some across, about half-way, made. Then the whole case is oiled, including the exterior, and plaster is poured, quite thick, on the whole model, beyond the teeth, so that they are covered up to the rubber, on the inner side. When the plaster has well hardened, we saw apart this outside layer of plaster in the middle, or oiled paper or tin foil may have been inserted into the soft plaster. We can now separate both sides with care and put them into water so that they may be well soaked. Then the palate plate is sawed out almost up to the teeth all around, and the teeth and clasps are removed from the remaining rim of rubber. Now we put the palate plate again on the plaster now serving as model, put the teeth in their places, and also the clasps in their right place. Both sides are now attached and tied together, or held with the hand, and some wax melted in a spoon and poured between the teeth; if we turn the model as required, the wax will run everywhere. It fastens the teeth and takes precisely the form of the removed rubber. The two side overcoatings, to which the wax, on account of their humidity, does not adhere, can now cautiously be removed, and after taking away unnecessary wax, and modelling tastefully the case elsewhere, we fasten it on the model and proceed with the rest as already shown.

It is better to vulcanize on the model than to simply plaster the wax piece as, when removing, it might, on account of the clasps and the irregular form of the cavity, very easily be distorted.

[To be continued.]

SELECTIONS.

ON THE RELATIONS BETWEEN DENTAL LESIONS AND DISEASES OF THE EYE.

BY HENRY POWER, M. B. LOND., F. R. C. S.,

Opthalmic Surgeon at St. Bartholomew's Hospital, and Surgeon to the Royal Westminster Opthalmic Hospital, &c.

[Read at a meeting of the Odontological Society of Great Britain, November 5th, 1883, and reprinted from the Transactions of the Society.]

[Concluded from page 188.]

I now proceed to the consideration of the last class of cases into which I divided the ocular troubles caused by dental lesions, namely,

those in which the reflex action is exerted upon the optic nerve and retina and intra-ocular structures.

And first in regard to the occurrence of *amaurosis*; the most brilliant case on record is one that is now of somewhat ancient date, having been given by Sir William Lawrence, but which is so convincing that I venture to reproduce it here.

"CASE 7. *Amaurosis caused by a carious tooth.*—F. P., thirty years of age, possessing a good constitution, and enjoying good health, with the exception of pains in the head and limbs, which never lasted long, suddenly experienced, in the autumn of 1825, a violent pain, shooting from the left temple to the eye and the side of the face; he ascribed it to cold. This pain lasted several days, then lessened, and reappeared from time to time without being sufficiently severe to induce the patient to seek medical aid. In about two months it suddenly increased in intensity, occupying the eye particularly, with a feeling as if it would pass out of the orbit. F. P. now discovered that he was blind with that eye, and applied to a neighboring physician, whose treatment, continued for two months, did no good. The pain, however, was no longer continual; it assumed a somewhat periodical character, leaving the patient easy for some hours of the day. At the end of the following six months the pain increased, the cheek swelled, some spoonfuls of bloody matter were discharged by a spontaneous opening in the lower eyelid, after which the swelling subsided, and the pains nearly disappeared, although the blindness remained complete. The discharge was removed from time to time during the following six months, and there was no great suffering. But in the autumn and winter (1826) the pain, particularly in the eye, became so violent that F. P. came to Wilna in the beginning of 1827, determined to have the organ extirpated if no other remedy could be found. Professor Galezowski found the left eye totally insensible to light, with the pupil dilated and no other visible alteration. The pain, not then so severe, consisted in violent occasional pricking or darting sensations in the left temple, and parts round the eye. There was discharge from the lower eyelid. The first molar tooth of the left side was carious; it had not caused much uneasiness; and the toothache, when it existed, had not coincided with the pains in the temple and eye. The Professor determined on removing this tooth, and having done so, was surprised to see a small foreign body at the extremity of the fang. When drawn out it proved to be a small splinter of wood, about three lines in length, which had

traversed the center of the tooth, and had probably been introduced in picking the teeth. A probe was passed from the socket into the antrum, from which a few drops of thin purulent fluid escaped. The pain ceased almost entirely, and on the same evening the eye began to be sensible to light. Vision gradually improved, so that, on the ninth day, the patient could see as well with the left eye as with the right, after a blindness of thirteen months; on the eleventh day he left Wilna to return to his family."

"I had," says Sir William, "the pleasure of becoming acquainted with Professor Galezowski when he visited England subsequent to this occurrence. He showed me the tooth and the splinter of wood, and he pointed out two circumstances in the case as particularly worthy of notice: First, that the entrance of the foreign body into the tooth had not been noticed at the time; and secondly, that a local irritation, hardly perceived at the seat of injury, should have affected the ramifications of the nervus trigeminus so violently as to produce amaurosis."

I have met with no other case that is so complete as this; but Caffe refers to a case in which blindness proceeded from a carious tooth in the upper jaw, and occurred whenever food collected in the cavity; and I have myself recently met with a case in which loss of vision occurred for a few minutes each time that, in clearing the cavity of a carious molar for plugging, the instrument caused pain.

Sir Thomas Watson refers to the repeated occurrence of blindness cured by the extraction of irregularly arranged teeth. Sudden blindness occurred in a boy eleven years of age. This was immediately cured by the removal of two permanent and four milk molars from a very closely compressed set of teeth; and Garretson reports a case given by Salter. A woman, twenty-four years of age, suffered from violent pain in the right upper first molar, which was accompanied with great swelling of the face; the globe was protruded and vision was lost. A fistulous opening, from which pus flowed abundantly, existed at the outer as well as at the inner angle of the antrum. The cause of the suppuration in the antrum was the remains of the first upper molar; when this was removed a sound was passed into the antrum and a sequestrum was brought away. This proved to be the antral part of the floor of the orbit, the upper part of the malar bone, with the foramen infra-orbitale, and a broad, bony plate of the nasal wall of the antrum. The inflammatory symptoms immediately subsided, but there was no perception of light, and the pupil

remained immovable. Five weeks subsequently the pupil began to respond to light, but there was no return of vision. Ophthalmoscopic examination of the eyes showed white atrophy of the optic disks. Gill concludes his essay with the statement that the phenomena which depend upon the optic nerve are attributable to a plastic inflammation, which affects the extra-cranial portion of the nerve. If the optic nerve is destroyed by this means, the blindness is persistent. The oculomotor nerve suffers temporarily only; therefore also there is only temporary rigidity of the pupil. The protrusion of the bulb indicates that the sixth nerve is little or not at all affected. Mr. Gill is doubtful whether to regard the anæmia of the optic nerve as a cause or a consequence of the abolished function.

A case of sympathetic disease of the eyes in consequence of irritation of the dental nerves is given in the "Revue de Thérap. Med.-Chir.," August, 1871. The ocular and palpebral conjunctiva of the eyes and eyelids were much congested; the vessels filled to the corneal border. Severe pain was experienced at night; there was considerable photophobia; the head was heavy and painful, tongue coated, appetite bad, pulse small and frequent. The affection lasted five months. Ten leeches were applied to the angle of the jaw, a collyrium of sulphate of zinc and a purgative prescribed, which led to some improvement. After the application of a blister to the back of the neck, the pain recommenced. As the left molar was very carious it was removed, with the effect of immediately removing the symptoms, and in the course of a week the patient could use the eye again.

Gill, about the year 1873, read a paper before the Missouri State Medical Association, on "Disturbances of vision resulting from neuralgia of the fifth pair of nerves consequent on dental affections," which I have not been able to procure, but which is translated in the "Deutsches Vierteljahrschrift für Zahnsheitkunde," B. IV, p. 11, and is fully abstracted in the section on "Mund und Zahnkrankheiten," by Dr. Albrecht, in the "Jahresbericht für Gesammten Medicin" (V. Virchow, V. Hirsch) for 1873, B. II, p. 537. The following case is given in this paper. The patient was thirty-three years of age, and in the early part of the winter of 1870–71 began to experience neuralgic pains in the head and face, which lasted to the middle of summer. The neuralgia extended over both sides of the head, and so far affected the visual power that the patient was no longer capable of reading. In the middle of the summer the neuralgia disappeared,

and the vision became normal. In July, 1871, the neuralgia recurred, and coincidently there was diminution of visual power; the patient could only read Jäger No. 16. The pain experienced was especially severe at night. Examination with the ophthalmoscope showed that there was sub-retinal effusion, and that the retinal arteries were ill-defined. There was a well-marked painful spot.

Examination of the apparently sound teeth showed that there was necrosis of the exposed left superior maxilla, but more careful examination demonstrated that the supposed necrosis was only a collection of tartar, which had surrounded the roots of the first and second molars. These two teeth were extracted, and a wide zone of ulceration was found around their roots, and to a smaller extent about the root of the second bicuspid, which after the lapse of a few days was also removed. The neuralgic symptoms immediately abated; the amblyopia, or dimness of vision, was reduced, and in the course of a week the patient could read again No. 6.

Mr. Hutchinson, in one of the early volumes of the Ophthalmic Hospital Reports, has pointed out that certain cases of amaurosis bear a very close resemblance to infantile paralysis. "Without any warning whatever, without any cerebral symptoms, a patient loses the sight of one eye, and now and then, but very rarely, of both eyes." In some cases, he goes on to remark, there is a certain amount of improvement afterwards, but often the amaurosis becomes total and permanent. In some instances the optic disk becomes white and atrophic, but in others it retains an almost normal vascular supply. Most of the cases which had come under his notice were women. In some, evidence of cardiac disease existed; in others there was none; and in most he found the *arteria centralis* of good size, so that the hypothesis of embolism seemed to him to have but little support. In several of the best marked cases that he had seen there was a history of neuralgia in the face for a long time before the occurrence of the amaurosis, the neuralgia being usually connected with toothache.

Alexander of Aachen has reported the following case of amaurosis resulting from dental disease.

A patient, æt. twenty-six, had slight myopic astigmatism, which was, however, insufficient in amount to explain the greatly lowered visual power of the right eye. The right optic disk was somewhat hyperæmic. Abstraction of blood was ineffective, and in a subsequent examination the failure of vision was so great that the patient could only read Jäger No. 15. The patient then complained of

severe pain in the upper right anterior molar tooth, and observed that it had been for some time periodically affected. The tooth was extracted, and vision almost immediately rose to two-thirds of its normal amount in the right eye, and became quite normal in the left eye.

In this, as well as in other reported cases, the eyes have often been slightly defective originally, and it stands to reason that any sympathetic influence is more likely to be felt by those in whom the functions of the eye are from any other cause impaired; or perhaps it might be said that sympathetic affections are more likely to be superimposed upon defective than upon sound eyes. Thus a patient who has perfectly healthy eyes may long resist the depressing influence of toothache, but if his eyes are already congested or exhausted from uncorrected hypermetropia, it is easily intelligible that pain, by depressing the nervous energies, will cause the weakness of the ciliary muscle to be felt at an earlier period.

A similar case, in which an amaurotic condition of the eyes was improved by the removal of the stopping from a carious tooth, and was subsequently entirely cured by the removal of the tooth, has been reported by Dr. M. F. de Witt. A strong and healthy man, æt. thirty-one, discovered that his right eye was blind. No pain, no photopsiæ had been experienced. He could distinguish light from darkness with the affected eye, but that was all. He was unable to give any account of the cause of the attack, but after awhile he remembered that two months before losing his vision several teeth had been stopped. He had often felt pain near the first molar tooth of the right side, and he had often also experienced pain and tenderness of the gums, and abscesses had formed which he had himself opened with a penknife. On examination the tooth was found to be reduced to a shell, with a fistulous opening leading to the alveolus. Dr. de Witt, suspecting irritation of the fifth nerve proceeding from the teeth, removed the stopping in order to obtain a counter-opening, and to permit the fistulous orifice to close and to arrest the irritation. The immediate effect was that the gum ceased to be sore, and the visual power began to improve. After three weeks, when the sharpness of vision had greatly improved, the gums again began to be sore, and coincidently the acuteness of vision diminished. The affected tooth was extracted, and improvement then again took place, and vision became restored almost to its normal amount, though still not equal to that of the other. The fang of the tooth was filled with pus.

M. Nicaise remarks that he knew that in certain cases the irritation of a dental nerve may induce troubles, which indeed are often only transitory, of vision. These disturbances are explicable on the ground of the intimate relations which exist between the different branches of the fifth pair of nerves, the function of which is sensory, and which govern also the nutrition of the regions to which they are distributed. If the irritation of the fifth nerve is persistent, and if it ends by effecting some alteration in the nerves, it is possible that the disturbances of vision may become more serious and even permanent. Glaucoma, which is especially due to troubles of nutrition, may possibly have its point of departure in a lesion affecting the superior or inferior dental nerves. . . . . .

The writing of this paper has recalled to my memory various cases which were in the highest degree suggestive of the teeth being the starting-point of the trouble, and to which I regret extremely I did not direct a larger amount of care and attention at a period when it might have proved of service. To give one only:

Mrs. S., æt. thirty-two, a stout, ruddy-complexioned woman, suffered in 1878 and 1879 from colored haloes round lights, and the general symptoms of glaucoma. For these there was no apparent cause. She was healthy, in easy circumstances, and her habit of body and general manner of life were thoroughly normal and good. She, however, suffered severely from toothache. A particular tooth would begin to ache, without apparent decay of the crown. After enduring the pain for some time she would have the tooth extracted, and an abscess was always found to exist at the root. In March, 1880, after a fall which intensified all the symptoms, an iridectomy was performed on the left eye. The wound did not heal kindly, and a cystoid cicatrix was the result. The vision gradually deteriorated, and ultimately was entirely lost.

She now had two miscarriages, and some circumstances occurred in the family causing her much mental distress and depression of spirits, with frequent shedding of tears. I saw her first about eighteen months after the operation had been done.

The right eye was now the seat of trouble, but the vision was still very good, and with appropriate glasses (+ 1 D) could be rendered perfect. Three weeks previously she had awaked with violent pain, which lasted for three days; she saw bright lights, and the eye was hard, and the optic disk was white and cupped. She was told she had glaucoma, and that if the vision deteriorated she must submit to

an operation. It did deteriorate rapidly, and I performed an iridectomy in the hope of saving vision, but the wound passed through the same stages as with the previous operation, and a cystoid cicatrix was formed with persistent high tension of the globe of the eye. I saw her only a few days ago with complete blindness of the left eye, and only perception of very bright light in the right eye. She again repeated to me the story of the teeth, and I could not but think that if a similar case appeared before me now, instead of trying iridectomy —which was here a signal failure, even when performed by two different operators, and which resisted eserine, and all the usual methods of reducing tension—I should at once have every tooth carefully and thoroughly inspected by an experienced dental surgeon. And I would ask whether such a case is not adapted for the removal and replantation of teeth, if these, after extraction, were found to be sound.

I fear, Mr. President and Gentlemen, that I have wearied you with cases, but I trust I may stand excused when I say that most of these cases are germane to the matter, and that my object has been in part to draw the attention of some amongst you who may not have given it a thought, to the close relationship which exists between the teeth and the eye, different as these organs are in their mode of development, their histological characters, and physiological uses, and in part to elicit from you some information that may prove of service to the ophthalmic surgeon, and may afford him some hints of the kinds of disease of the teeth which he is likely to overlook, and which it is important that he should recognize.

In conclusion, then, I think it may be laid down as a maxim to be generally observed that in all cases of threatening glaucoma, especially when this is associated with ciliary neurosis and obscure pains in the temples and maxillary orbital regions—in all cases of mydriasis, and probably of myosis, originating without apparent causes—in all cases of sudden paralysis of either of the orbital muscles, or of loss of sensation in the absence of cerebral symptoms—in all cases of phlyctenular disease of the conjunctiva—in all cases of ulcers of the cornea resisting ordinary treatment—in all cases of sudden failure of accommodation, especially in young children—and finally, in cases of exophthalmia, the condition of the teeth should at least be examined, and if faulty conditions present themselves these should be at once rectified, and then one at least of the possible causes of each of these diseases will be removed.

BOOKS AND PAMPHLETS.

NOTES ON DENTAL PRACTICE, by Henry C. Quimby, Licentiate in Dental Surgery of the Royal College of Surgeons in Ireland and Member of the Odontological Societies of New York and London. Published by the S. S. White Dental Manufacturing Co., Philadelphia.

This is a work of about two hundred pages, well printed and illustrated, and is confined, principally, to "the treatment of abnormal conditions of the teeth." It is the result of the teachings of the personal experience of one who has seen much practice, and who thus makes known to the profession the lessons gained. All such works possess much value and add to the available knowledge of the profession. Such publications are to our professional literature what the relation of "incidents of office practice" is to our dental meetings. The aggregation of personal experience and the statements of individual methods constitutes much of our most practical literature, and as such we can cordially recommend Quimby's Notes to the profession.

LISTERINE—Opinions from the dental and medical professions is the subject of an elegantly bound little volume—cloth—laid upon our table by Lambert & Co., Manufacturing Chemists, 307 Locust street, St. Louis, Mo. It presents extracts from the opinions of many well-known dental and medical gentlemen whose experience with Listerine has been favorable. Also the formula, dose, etc. Listerine seems to have become an essential in the practice of many of our best operators, and we hear it widely spoken of in the various society meetings with much favor.

By sending your name and address, the publishers will forward a copy to any who may wish.

IODOFORM IN DENTAL SURGERY, by C. F. W. Bödecker, D. D. S., M. D. S., New York. Reprinted from the *Independent Practitioner* of March and April.

An excellent paper by one of our best writers.

SOCIETIES.

The Massachusetts Dental Society will hold its semi-annual meeting, for 1884, at Boston, June 5 and 6.

The eighth annual meeting of the New Hampshire Dental Society will be held in Concord, June 17. Board of Censors will meet Monday evening, June 16, at 7 o'clock, at Phenix Hotel. Arrangements are being made to make this the largest and best meeting the society has had. All dentists of the State are cordially requested to be present.

E. B. DAVIS, *Sec.*

CONNECTICUT VALLEY DENTAL SOCIETY.

CHANGE OF DATE.

As the dedication of the Buckingham monument takes place at Hartford, June 18, the meeting of the Conn. Valley Dental Society has been changed from June 18 and 19 to June 19 and 20, at Savin Rock, New Haven, Conn.

W. F. ANDREWS, *Sec.*

MONTHLY LIST OF PATENTS.

For Inventions relating to Dentistry, bearing date April 22, and May 20, 1884. Reported expressly for this Journal by Louis Bagger & Co., Mechanical Experts and Solicitors of Patents, Washington, D. C.

295,821—Dental vulcanizer. F. W. Seabury, Providence, R. I.

296,078—Dental drill hand-piece. J. H. Siddall, Canton, Ohio.

296,690—Dental mold. J. W. Hayford, Tiffin, Ohio.

296,992—Dental rubber-dam holder. R. H. Hoffit, Harrisburg, Penn.

298,717—Dental foil condenser. R. S. Williams, New York, N.Y.

298,716—Wrinkling gold dental foil. R. S. Williams, New York.

298,483—Dental hand-piece. H. Laurence, Chicago, Ill.

299,040—Dental engine angle attachment. A. Weber, New York.